



Date: April 23, 1982

Subject: Primary Processes R & D
Monthly Report - April, 1982

From/Location: E. L. Cambridge

To/Location: J. G. Kaufman

BASIC RESOURCES RESEARCH

Bauxite Evaluation Capability

Bomb digestion equipment and NBS standard samples of bauxite have been ordered. A survey of methods is underway to identify analytical procedures applicable to general samples. The list of specific analyses necessary for evaluation and characterization was approved by Basic Resources.

AD-120 - AlCl_3 Process

Work has been concentrated on this process and continues on a broad front.

We have confirmed that chlorination with a partially calcined green coke reductant produces AlCl_3 containing less than 3 ppm PCB's. Additional experimentation is underway to define acceptable operating parameter ranges.

Comparative partial calcination experiments with $\text{Al}(\text{OH})_3$ and ACH were conducted over the 400°-800°C temperature range. The residual H_2 level in both the alumina trihydrate and the ACH at 400°C as specified in the CSIRO patent is unacceptably high. This indicates that clay rather than bauxite is the preferred ore for this process and confirms Alcoa's conclusion that aluminum trihydrate must be fully calcined. Also, the CSIRO patent can be effectively bypassed.

Equipment to measure mass transfer numbers has been set-up. A gas chromatograph is being calibrated to improve the accuracy of this measurement. Initial results confirm it is possible to obtain a mass transfer coefficient of 14 vs Alcoa 7, using ACH and CO as a reductant. This was our base case assumption in the economic evaluation.

A 2" fluidized bed reactor was designed and constructed. It will be used for upcoming chlorination kinetic experiments.

In extended tests (100 hr) of refractory materials for the Alcoa reactor and bipolar cell, it was found that Sialon-bound Al_2O_3 furnished by Harbison-Walker failed completely while Sialon-bound Mullite showed only minor effects. In comparative tests of refractories made by Anaconda, the following results were achieved.

<u>Composition</u>	<u>Results - Compared to Sialon-Mullite</u>
1/3 MgF_2 -1/3 AlF_3 -1/3 AlN	equal to slightly inferior
3/4 MgF_2 -1/4 AlN	equal to slightly better
1:1 MgF_2 - Al_2O_3	a fair amount better

Two additional compositions are in the process of being tested which will conclude our investigations until any Alcoa joint effort dictates further and more detailed tests.

REDUCTION RESEARCH

AD-108 Composite Anode Process

Several experiments using a composite powder anode with a porous diaphragm were carried out. This work is encouraging, although there are still problems with electrolyte wettability, diaphragm design and getting current to the working anode. We have several ideas to resolve these problems and work will continue.

Cyclic voltametric experiments using both prebaked and composite anodes continued using various electrolyte compositions. A composite anode can be electrolyzed in a mixed chloride/fluoride melt without chlorine evolution up to at least 1.4 amps/cm². Further studies will be conducted with the potentiostat to characterize various chloride/fluoride bath compositions and electrode designs.

A furnace has been modified and rebuilt for modelling the self-baking composite anode. Tests will be initiated next month.

AD-116 Potlining Resource Recovery

A fourth meeting was held with Alcan to review capital and operating cost estimates for the Alcan Mini-L and D process and the AD-116 process. The D-process was eliminated from further consideration. This effectively concludes the joint feasibility study investigation and the project team is now preparing a report for respective managements. It is anticipated that this report will recommend proceeding with a joint development program.

Petroleum Pitch

Ashland 240 pitch composites prepared in the Columbia Falls lab still do not achieve satisfactory baked carbon density. As the same result, low density, has also been obtained with lab-prepared coal-tar pitch composites when compared to plant production, a comprehensive review of lab procedures will be carried out early in May.

DEVELOPMENT & TECHNICAL SERVICES

Lithium Fluoride

Continued improvement in operation of the lithium cells at Sebree was experienced in March. March current efficiency was 93.9% bringing the cumulative average to 90% since additions started. Anode effect frequency remains high at 2.7 vs 1.6 plant average. Future work on this project is uncertain with the Line 2 shutdown.

Columbia Falls started lithium additions to five cells. Concentration is now at 0.5% with no problem to date.

Pot Magnetics

Magnetics probe shielding cooling manifolds have been constructed and will be tested this week. A contractor (Erico) has done some testing of molds for exothermic busbar welding. Results are satisfactory for the S-risers but more testing is required for the bus tab joint.

Columbia Falls Anode Optimization

A proposal to optimize anode formulation for existing pitches and cokes was prepared and accepted by Columbia Falls management. We are currently formulating the project team and anticipate starting Phase I of the study in late May.

Sebree 24-Day Large Anode Study

Early in April, a study was initiated to investigate the feasibility of a 24-day anode in conjunction with the large anode work currently being performed. Early studies from a technical standpoint reveal that a 24-day anode is achievable with no major drawbacks. With a 24-day anode, anode production and set requirements will be reduced by 25%, resulting in reduced labor requirements and possible improved cell performance.

Other

Sam Jones conducted a Carbon Seminar at Columbia Falls March 29-April 2. This was well received.

PERSONNEL

Mr. David B. Baker was hired as a Technician - Reduction on April 5. Ms. Inge Vogelmann accepted the position of Senior Technician - Carbon, effective April 19. Inge was formerly with the Anaconda Minerals Process Engineering group. Interviewing for several open profession positions is currently underway.

FACILITIES

The Carbon and Reduction Research Lab construction is about two weeks ahead of schedule and under estimate. Laboratory equipment purchase continues. With 53% of the costs accountable, we are currently \$10,500 (6% of allowed cost) under budget for equipment purchase. Currently, inventory and open purchase order lists are being compiled for better control of the project. Inge Vogelmann is developing a permanent instruction and service manual file as the equipment arrives; providing copies for the users of the equipment.

The BET surface area apparatus has arrived in Tucson and future surface area measurements will not have to be sent out for analysis.



E. L. CAMBRIDGE

ELC:pm

cc: R.W.Bartlett
File: 0.8.1